Amendments to the Specification

Please replace paragraph [0001] with the following amended paragraph:

[0001] This application is a continuation-in-part of co-pending United States Patent Application Serial No. 10/140,010, filed May 7, 2002, issued as U.S. Patent No. 6,979,248. This application is also a continuation-in-part of co-pending United States Patent Application No. 10/211,626, filed August 2, 2002, issued as U.S. Patent No. 7,125,477, which is a continuation-in-part of co-pending United States Patent Application No. 10/033,732, filed December 27, 2001, issued as U.S. Patent No. 7,066,800, which is a continuation-in-part of United States Patent Application No. 09/505,899, filed February 17, 2000, issued as U.S. Patent No. 6,537,144. This application is additionally a continuation-in-part of co-pending United States Patent Application Serial No. 10/210,972, filed August 2, 2002, which is also a continuation-in-part of United States Patent Application No. 09/505,899, filed February 17, 2000, issued as U.S. Patent No. 6,537,144. This application is further a continuation-in-part of co-pending United States Patent Application No. 10/151,538, filed May 16, 2002. All of the above referenced applications are hereby incorporated by reference in their entireties. This application is related to United States Patent Application Serial No. 10/033,732, issued as U.S. Patent No. 7,066,800, filed on December 27, 2001; United States Patent Application Serial No. [[ ]]10/455,941, filed June 6, 2003, issued as U.S. Patent No. 6,991,528 (Attorney Docket No. 4100P4/CMP/CMP/RKK) entitled "Conductive Polishing Article for Electrochemical Mechanical Polishing" by Hu, et al.; and United States Patent Application Serial No. [[ ]] 10/455,895, filed June 6, 2003 (Attorney Docket No. 4100P5/CMP/CMP/RKK) entitled "Conductive Polishing Article for Electrochemical Mechanical Polishing" by Hu, et al., all of which are also incorporated herein by reference in their entireties.

Please replace paragraph [0077] with the following amended paragraph:

[0077] The electrode 204 is generally positioned between the disc 206 and the bottom 210 of the basin 202 where it may be immersed in the electrolyte 220. The electrode 204 can be a plate-like member, a plate having multiple apertures formed therethrough, or a plurality of electrode pieces disposed in a permeable membrane or container. A permeable membrane (not shown) may be disposed between the disc 206 and the electrode 204 or electrode 204 and polishing article 205 to filter bubbles, such as hydrogen bubbles, ~~form~~ from the wafer surface and to reduce defect formation and stabilize or more uniformly apply current or power therebetween.

Please replace paragraph [0089] with the following amended paragraph:

[0089] Additionally, the invention contemplates using electrolyte compositions conventionally used in electroplating or electropolishing processes, including conventionally used electroplating or electropolishing additives, such as brighteners among others. One source for electrolyte solutions used for electrochemical processes such as copper plating, copper anodic dissolution, or combinations thereof is Shipley Leonel, a division of Rohm and Haas, headquartered in Philadelphia, Pennsylvania, under the tradename Ultrafill 2000. An example of a suitable electrolyte composition is described in United States Patent Application Serial No. 10/038,066, filed on January 3, 2002, published as U.S. Patent Publication No. 2002/0130049, which is incorporated by reference in its entirety.

Please replace paragraph [0093] with the following amended paragraph:

[0093] When contacting the substrate surface, a pressure of about 6 psi or less, such as about 2 psi or less is applied between the polishing article 205 and the substrate surface. If a substrate containing low dielectric constant material is being polished, a pressure between of about 2 psi or less, such as about 0.5 psi or less is used to press the substrate 114 against the polishing article 205 during polishing of the substrate. In one aspect, a pressure between about 0.1 psi and about 0.2 psi may be

used to ~~polishing~~ polish substrates with conductive polishing articles as described herein.

Please replace paragraph [0101] with the following amended paragraph:

[0101] The conductive fiber material may comprise intrinsically conductive polymeric materials including polyacetylene, polyethylenedioxythiophene (PEDT), which is commercially available under the trade name Baytron™, polyaniline, polypyrrole, polythiophene, carbon-based fibers, or combinations thereof. Another example of a conductive polymer is polymer-noble metal hybrid materials. Polymer-noble metal hybrid materials are generally chemically inert with a surrounding electrolyte, such as those with noble metals that are resistant to oxidation. An example of a polymer-noble metal hybrid material is a platinum-polymer hybrid material. Examples of conductive polishing materials, including conductive fibers, are more fully described in co-pending U.S. Patent Application Serial No. 10/033,732, filed on December 27, 2001, and issued as U.S. Patent No. 7,066,800, entitled, "Conductive Polishing Article For Electrochemical Mechanical Polishing", which is incorporated herein by reference in its entirety. The invention also contemplates the use of organic or inorganic materials that may be used as fibers described herein.

Please replace paragraph [0121] with the following amended paragraph:

[0121] The article support portion 320 may comprise inert materials in the polishing process and are resistant to being consumed or damaged during ECMP. For example, the article support portion may be comprised of ~~a~~ conventional polishing materials, including polymeric materials, for example, polyurethane and polyurethane mixed with fillers, polycarbonate, polyphenylene sulfide (PPS), ethylene-propylene-diene-methylene (EPDM), Teflon™ polymers, or combinations thereof, and other polishing materials used in polishing substrate surfaces. The article support portion 320 may be a conventional soft material, such as compressed felt fibers impregnated with urethane, for absorbing some of the pressure applied between the polishing article 205

and the carrier head 130 during processing. The soft material may have a Shore A hardness between about 20 and about 90.

Please replace paragraph [0124] with the following amended paragraph:

[0124] Generally, the conductive polishing portion 310 is adhered to the article support portion 320 by a conventional adhesive suitable for use with polishing materials and in polishing processes. The invention contemplates the use of other means to attach the conductive polishing portion 310 onto the article support portion 320 such as compression molding and lamination. The adhesive may be conductive or dielectric depending on the requirements of the process or the desires of the manufacturer. The article support portion 320 may be affixed to a support, such as disc 206, by an adhesive or mechanical clamp. Alternatively, if polishing article 205 only includes a conductive polishing portion 310, the conductive polishing portion may be affixed to a support, such as disc 206, by an adhesive or mechanical clamp.

Please replace paragraph [0129] with the following amended paragraph:

[0129] Grooves may be disposed in the polishing article 205 to promote electrolyte flow across the polishing article 205 to provide effective or uniform electrolyte flow with the substrate surface for anodic dissolution or electroplating processes. The grooves may be partially formed in a single layer or through multiple layers. The invention contemplates grooves being formed in the upper layer or polishing surface that contacts the substrate surface. To provide increased or controlled electrolyte flow to the surface of the polishing article, a portion or plurality of the perforations may interconnect with the grooves. Alternatively, ~~the~~ all or none of the perforations may interconnect with the grooves disposed in the polishing article 205.

Please replace paragraph [0132] with the following amended paragraph:

[0132] Electrolyte transport to the surface of the substrate may be enhanced by intersecting some of the perforations with the grooves to allow electrolyte to enter through one set of perforation, be evenly distributed around the substrate surface by the grooves, used in processing a substrate, and then processing electrolyte is refreshed by additional electrolyte flowing through the perforations. An example of a pad perforation and grooving is more fully described in United States Patent Application Serial No. 10/026,854, filed December 20, 2001, published as U.S. Patent Publication No. 2002/0102853, which is incorporated by reference in its entirety.

Please replace paragraph [0145] with the following amended paragraph:

[0145] Alternatively, a conductive mesh may be used in place of the conductive cloth or fabric 700. The conductive mesh may ~~comprises~~ comprise conductive fibers, conductive fillers, or at least a portion of a conductive cloth 700 disposed in or coated with a conductive binder. The conductive binder may comprise a non-metallic conductive polymer or a composite of conductive material disposed in a polymeric compound. A mixture of a conductive filler, such as graphite powder, graphite flakes, graphite fibers, carbon fibers, carbon powder, carbon black, metallic particles or fibers coated in a conductive material, and a polymeric material, such as polyurethane, may be used to form the conductive binder. The fibers coated with a conductive material as described herein may be used as a conductive filler for use in the conductive binders. For example, carbon fibers or gold-coated nylon fibers may be used to form a conductive binder.

Please replace paragraph [0147] with the following amended paragraph:

[0147] The composition of the conductive fillers and/or fibers and polymeric material may be adapted to provide specific properties, such as conductivity, abrasion properties, durability factors. For example conductive binders comprising between about 2 wt.% and about 85 wt.% of conductive fillers may be used with the articles and processes described herein. Examples of materials that may be used as conductive

fillers and conductive binders are more fully described in U.S. Patent Application Serial No. 10/033,732, filed December 27, 2001, published as U.S. Patent Publication No. 2002/0119286, which is incorporated herein by reference in its entirety.

Please replace paragraph [0160] with the following amended paragraph:

[0160] The window 702 includes a fluid barrier 706 that substantially prevents processing fluids from reaching the area of the disc 206 housing the sensor 704. The fluid barrier 706 is generally selected to be transmissive (e.g., to have minimal or no effect or interference) to the signals passing therethrough. The fluid barrier 706 may be a separate element, such as a block of polyurethane coupled to the polishing article 205 within the window 702, or be one or more of the layers comprising the polishing article 205, for example, a sheet of mylar underlying the conductive portion 310 or the article support, or sub-pad, portion 320. Alternatively, fluid barrier 706 may be disposed in the layers disposed between the polishing article 205 and the disc 206, such as the electrode 204 or other layer. In yet another alternative configuration, the fluid barrier 706 may be disposed in a passage 708 aligned with the window 702 in which the sensor 704 resides. In embodiments wherein the conductive portion 310 comprises multiply layers, for example, an upper layer 794 and a lower layer 792, the transparent material 706 may be disposed in at least one layer comprising the conductive portion 310 as shown in Figure 7F. It is contemplated that other configurations of conductive polishing articles, including those embodiments described herein along with other configurations, may be adapted to include a window.

Please replace paragraph [0193] with the following amended paragraph:

[0193] Further examples of conductive polishing pads are described in United States ~~Provisional~~ Patent Application Serial Number 10/033,732, published as U.S. Patent Publication No. 2002/0119286, filed December 27, 2001, which is incorporated by reference in its entirety.

Please replace paragraph [0194] with the following amended paragraph:

[0194] Power may be coupled into the polishing articles 205 described above by using a connector as described herein or a power transference device. A power transference device is more fully detailed in United States ~~Provisional~~ Patent Application Serial Number 10/033,732, published as U.S. Patent Publication No. 2002/0119286, filed December 27, 2001, which is incorporated by reference in its entirety.

Please replace paragraph [0198] with the following amended paragraph:

[0198] Figure 12B is a cross-section schematic view of one embodiment of a connector 1225 coupled to a power source (not shown) via a conductive pathway 1232, such as a wire. The connector comprises an electrical coupling 1234 connected to the conductive pathway 1232 and electrically coupled to the conductive polishing portion 1210 of the extension 1215 by a conductive fastener 1230, such as a screw. A bolt 1238 may be coupled to the conductive fastener 1230 securing the conductive polishing portion 1210 therebetween. Spacers 1236, such as a washer, may be disposed between the conductive polishing portion 1210 and the fastener 1230 and bolt 1238. The spacers 1236 may comprise a conductive material. The fastener 1230, the electrical coupling 1234, the spacers 1236, and the bolt 1238 may be made of a conductive material, for example, gold, platinum, titanium, aluminum, or copper. If a material that may react with the electrolyte is used, such as copper, the material may be covered in a material that is inert to reactions with the electrolyte, such as platinum. While not shown, alternative embodiments of the conductive fastener may include a conductive clamp, conductive adhesive tape, or a conductive adhesive.

Please replace paragraph [0207] with the following amended paragraph:

[0207] In one embodiment, a resilient member 1410 may be disposed in the respective slots 1408 between the abrasive elements 1406 and the conductive portion 1404. The resilient member 1410 allows the abrasive elements 1406 to move relative

to the conductive portion 1404, thereby providing enhanced compliance to the substrate for more uniform removal of the passivation layer during polishing. Moreover, the compliance of the resilient member 1410 may be selected to ~~tailored~~ tailor the relative pressure applied to the substrate by the abrasive elements 1406 and the polishing surface 1402 of the conductive portion 1404, thereby balancing removal rate of the passivation layer against the rate of passivation layer formation so that the metal layer being polished is minimally exposed to the abrasive elements 1406 to minimize potential scratch generation.

Please replace paragraph [0208] with the following amended paragraph:

[0208] Figures 15A-D are top and sectional views of alternative embodiments of a conductive article 1500. The conductive article 1500 includes conductive rollers 1506 extending from a polishing surface 1502 of an upper portion 1504 of the conductive article 1500. The rollers 1506 can be urged down to the same plane of the polishing surface 1502 by a substrate during polishing. The conductive rollers embedded in the conductive article 1500 are coupled to an external power source 1536 at high voltage for high removal rate of bulk polishing substrate during processing.

Please replace paragraph [0209] with the following amended paragraph:

[0209] The conductive rollers 1506 may be fixed relative to the upper portion 1504, or may be free to roll. The conductive rollers 1506 may be balls, cylinders, pins, ellipsoidal or other shapes configured not to scratch the substrate during processing.

Please replace paragraph [0210] with the following amended paragraph:

[0210] In the embodiment depicted in Figure 14B, the conductive rollers 1506 are a plurality of balls disposed in one or more conductive carriers 1520. Each conductive carrier 1520 is disposed in a slot 1508 formed in the polishing surface 1502 of the conductive article 1500. The conductive rollers 1506 generally extend from the polishing

surface 1502 and are configured to provide electrical contact with the metal surface of the substrate being polished. The conductive rollers 1506 may be formed from any conductive material, or formed from a core 1522 at least partially coated with a conductive covering 1524. In the embodiment depicted in Figure 14B, the conductive rollers 1506 have a polymer core 1522 at least partially covered by a soft conductive material 1524. An example is a TORLON™ polymer core coated with conductive gold layer using copper as seeding layer between TORLON™ and gold layer. Another example is TORLON™ or other polymer core coated with a layer of copper or other conductive material. Other soft conductive materials 1524 include, but are not limited to, silver, copper, tin and the like.

Please replace paragraph [0219] with the following amended paragraph:

[0219] In yet another embodiment, the roller 1506 may be configured with a specific gravity less than the electrolyte so that the buoyancy of the roller 1506 when the housing 1530 is at least partially filled with electrolyte biases the roller 1506 away from the disc 206. The roller 1506 may be optionally hollow to increase the buoyancy and decrease the inertia of the roller 1506. One housing having a roller coupled to a power source through a contact member that may be adapted to benefit from the invention is described in previously incorporated United States Patent Application No. 10/211,626, published as U.S. Patent Publication No. 2004/0023495.

Please replace paragraph [0227] with the following amended paragraph:

[0227] During processing, the switch 1574 is disposed in a first state that electrically couples the roller 1506 to the power source 1536 while opening the circuit between the conductive backing 1566 and the power source 1536. The rollers 1506 allow relatively high current flow between the substrate 114 and electrode 1554 thereby facilitating bulk removal of a conductive layer from the substrate. Once the conductive layer is substantially removed, the switch 1574 is disposed in a second state that electrically couples conductive backing 1566 ~~the~~ to the power source 1536 while

opening the circuit between the roller 1506 and the power source 1536. The conductive backing 1566 provides substantially uniform voltage potential across the width of the conductive layer 1562 to facilitate removal of residual conductive material from the substrate. Thus, both bulk and residual conductive material removal for a substrate may be performed on a single platen without lifting the substrate from the pad assembly 1540. Examples of other pad assembly that may be adapted to benefit from the invention is described below with reference to Figures 16-18. It is also contemplated that other pad assemblies may be utilized, including those described above and those incorporating windows that facilitate sensing polishing performance.

Please replace paragraph [0234] with the following amended paragraph:

[0234] Figure 16 is a sectional view of another embodiment of a conductive article 1700. The conductive article 1700 generally includes a conductive portion 1602 adapted to contact a substrate during polishing, a conductive backing 1610, an article support portion 1604 and an interposed pad 1706 sandwiched between the conductive portion 1602 and the article support portion 1604, having similar construction to the conductive article 1600 described above.

Please replace paragraph [0241] with the following amended paragraph:

[0241] In another example, a polymer conductive portion 1802 may be comprised ~~comprises~~ of a moldable material that is repulsive to the mold or die. The repulsive nature of polymer conductive portion 1802 causes a surface tension that causes stresses to be molded into the polymer conductive portion 1802 that pull the material away from the mold, thereby resulting in the rounding of the edges 1812 of the apertures 1806 upon curing.

Please replace paragraph [0263] with the following amended paragraph:

[0263] The upper portion of each of the apertures 2402 includes a relief or groove 2406 formed in the upper housing 2304. The groove 2406 is configured to receive the distal portions of the contact element 1914, thereby preventing restriction of electrolyte flowing between the ball 1906 and housing 2302 from an electrolyte source 1970. The electrolyte source 1970 provides electrolyte through the apertures 2402 and into contact with the substrate 114 during processing.

Please replace paragraph [0264] with the following amended paragraph:

[0264] During processing, the balls 2204 disposed within the housing 2302 are actuated towards the polishing surface 2206 by at least one of spring, buoyant or flow forces. The balls 1906 ~~are~~ electrically couple the substrate 114 to the power source 1972 through the contact elements 1914 and lower plate 2306. Electrolyte, flowing through the housing 2302 provides a conductive path between the electrode 2462 and biased substrate 114 thereby driving an electrochemical polishing process.

Please replace paragraph [0266] with the following amended paragraph:

[0266] While the foregoing is directed to various embodiments of the invention, other and further embodiments of the invention may be devised without departing from the basic scope thereof, and the scope thereof is determined by the claims that follow.